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PASSENGER STEAMER COMPLEMENT.

Kingston, Ont., Jan. 28.—At the north of Kingston and along the Canadian side of the St. Lawrence river from here to Brockville, the need of more uniform international marine laws is very much in evidence. Two years ago, there was a reciprocal agreement between the governments of United States and Canada regarding passenger steamer inspection, but, in the carrying out of this agreement, several disadvantages to the marine owners as both sides of the line appear. For instance, the Canadian law states that the passenger complement of a vessel shall be decided by multiplying the length by the breadth of the vessel at the water line, and dividing by a factor, according to the class (river, lake, etc.,) of the vessel. The United States law fixes the complement according to the seating capacity of all the decks. In one instance, a United States day passenger steamer was allowed 3,500 passengers in its own waters, while Canadian inspection gave it only 1,500. Taking the average case a United States steamer under its own laws will be allowed from 15 to 25 per cent more passengers than Canadian steamers of the same size and class are allowed. Under the reciprocal arrangement, the inspection of each country is accepted by the other, and therefore the Canadian boats get the short end of the deal.

The reciprocal arrangement hits the United States owners of small gasoline launches who wish to carry passengers between United States and Canadian ports, and a number of cases were in evidence here last season. Under the United States law, it is not necessary to inspect craft of fifteen tons and under, and yet such craft may carry passengers. Hence, owners of these boats have no inspection certificates to produce to the Canadian inspectors, and the latter, having no authority under the reciprocal arrangement to inspect United States boats, the small gasoline launches cannot carry passengers from Canadian ports. On the other hand, there is Canadian inspection of small gasoline launches carrying passengers, and the owners present their Canadian certificates to the inspectors across the border, and thus do business between the two countries, whereas the small United States boats cannot.

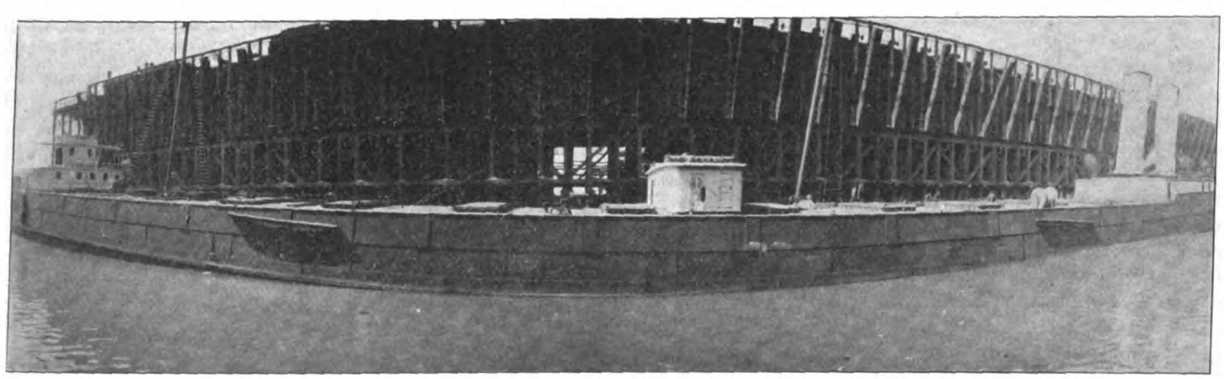
AID TO SHIPPING.

At the session of the National Convention for the Extension of Foreign Commerce of the United States at Washington last week, a resolution was adopted recommending the passage by Congress of such legislation as will promote the growth of the American merchant marine, but the convention refused to place itself on record in behalf of the ship subsidy bill before Congress. Its resolution recommended liberal compensation from the Government to American-built and American-manned ships for all services rendered, including the carriage of mails and the right to use the ships in time of war.

Speaker Cannon, in the lobby of the House, told several hundred delegates to the convention what he thought about the ship subsidy bill.

"It will give something like $4,000,000 to certain lines," he said, and he enumerated the lines, "which will not more than equal the sea postage of those lines." Sarcastically he added: "Some people call this a subsidy. I call it spending the people's money which we get from the postage on the sea service for the improvement of the sea service."

He added that he was willing to try the experiment.



THIS EXTRAORDINARY PHOTOGRAPH OF THE PITTSBURG STEAMSHIP CO.'S STEAMER DOUGLAS HOUGHTON WAS TAKEN BY AN AMATEUR WITH A PANORAMIC CAMERA WHILE THE STEAMER WAS AT THE ORE DOCK AT TWO HARBORS. IT WILL BE OBSERVED THAT GREAT LIBERTIES WERE TAKEN WITH THE STEAMER'S LONGITUDINAL SECTION BY THE CAMERA.

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NOTES ON THE DEVELOPMENT OF WARSHIP DESIGN.*

BY R. H. M. ROBINSON, NAVAL CONSTRUCTOR, U. S. N.

The press of official duties has prevented the treatment of the subject in the way that the writer could have wished, but with apologies for the somewhat cursory glances which it has been possible to give to the points herein, it is hoped that the paper may lead to discussion that will be profitable, and perhaps others who are familiar with the subject may supply details of matters upon which the writer has been able only to touch lightly.

The problems which confront the naval architect designing vessels for military purposes, while doubtless no more complicated than those facing our colleagues on the merchant side, are so different that it may be of interest to outline some of them, even if only in brief

In a recent address delivered at the Massachusetts Institute of Technology by a member of this Society, occurs a quotation from Ruskin, part of which reads as follows, and which may serve as justification for this paper: "Take it all in all, a ship of the line is the most honorable thing that man as a gregarious animal has ever produced."

Sir William White, in the first of his Cantor lectures, delivered January 29, 1906, states that "efficiency as a fighting machine is the *raison d'etre* of every warship," and defines a modern warship as "essentially a mobile gun platform capable of transporting weapons of offense to any desired sphere of action and bringing them into play against an enemy."

The writer realizes, and must refer to some of the points wherein the work of the military naval architect is simpler than that of his merchant colleagues.

In naval design, the naval architect is not hampered by many of the regulations governing the operation, inspection, and construction of merchant ships, or by the rules of registration societies as to scantlings and distribution of material in the hulls and appurtenances.

It has at times, though not within the writer's personal experience, been asserted that warships are too flimsily constructed, but under various conditions of service, both damaged and undamaged, they have proven themselves structurally and locally sufficiently strong, notwithstanding the fact that the percentage of weight allotted to hull structures of warships of all classes is materially less than in merchant ships.

This lighter construction is possible partly from the thorough and constant inspection which the regulations of a military service insure to all parts of a ship's structure.

The same comments apply to the propelling machinery, which, for a given horsepower, is always, in naval vessels, much lighter than is the case in merchant vessels.

The freedom from restraint in the matter of scantlings, permitting the distribution of weight as may appear best adapted in the particular structure to the obtaining of the maximum of efficiency on a minimum of weight, necessitates a high state of finish in workmanship and a consequent increase in cost of workmanship, and entails a constant, careful investigation of special materials, for special purposes, so that in rendering one phase of the problem of design simpler, another is made correspondingly more difficult.

The differences in the ordinary conditions of service between warships and merchant ships, the one cruising at low speeds and part power, and the other generally at high speeds and full power, involve difficulties in the design of machinery in the one not present in the other, and make it most important in this, as in the other portions of the ship, to take all possible precautions to reduce the weight while providing ample strength against the maximum stresses to be expected.

In common with our colleague on the merchant side, we have to consider and provide in our designs for suitable stability and structural strength in the undamaged condition, to consider the questions of speed, maneuvering, cost, and economy of maintenance, though this last not to the extent that is required of him. We do not have to consider the cargo-carrying and passenger-carrying features of the design. But unlike him, we are required to consider, and that most carefully, the questions of stability and strength in damaged conditions, the carrying and handling of ammunition to the best effect, and the questions of distribution of armament and of armor and other protection, to obtain the maximum of offensive and defensive qualities on the minimum weight. The location of the battery includes, in addition to the distribution and weight of fire, the ability to fight in a seaway; and this latter feature generally involves high top weights which have a marked effect on the form and dimensions of the warship.

It is a matter of common knowledge that the results of wars naturally modify the opinions of naval experts as to the most desirable features to be embodied in ships for naval purposes, sometimes to the extent of requiring entirely new types, sometimes only in requiring new details. Such experience has, in the past, led to such things as changes in size and location of battery, numbers of different calibers of guns, questions of installation or omission of torpedo-tubes and their location, alteration of opinion as to the most desirable speed for tactical and stragetical purposes, belief in a change in distribution and thickness of armor, and many other points.

Such war experience and that of peace-time maneuvers teaching, as they do, new lessons, distinctly tend toward changes even in vessels already laid down.

A warship being a complicated structure and requiring some time to construct, any modification made in the course of actual construction of a vessel must of necessity cause difficulty both to the designer and builder and therefore is done with reluctance by both, and it must further be more or less of a partial attainment of the desired result, not having been provided for in the consideration of the original characteristics of the design.

There is, in one of the series of Sir William White's lectures, referred to before, a very frank exposition of the difficulties the British Admiralty experienced during the construction of the Admiral class, leading to the great delay in completion of those vessels and their generally unsatisfactory condition after completion, the draught exceeding that for which designed, placing the armor belt lower in the water than intended. This was due to changes and alterations made during construction in the armor and armament of the vessels, in an endeavor to have the ships when completed represent the state of the art at the time of completion, rather than when designed.

To the extent experienced in these ships, the vessels of the U. S. service, at least during the period covered by this paper, have not suffered, but in a lesser degree some of them have. It seems pertinent here to quote from Sir William, who says: "The lesson learned during this period (the period of construction of the Admiral class) should never be forgotten. Rapidity and economy of construction and the fulfilment of the intentions of warship design can only be insured when all questions relating to armament and other important features have been settled before the work of construction is begun," and, it may be added, adhered to.

"Changes in armament, in particular, involving serious and costly alterations, cannot fail to prejudice, in some respects, the merits of the design and to retard the completion of the ship."

To a lesser extent, changes in other features than armor and armament have the same bad effect on the design, as every member of the Society knows how

*Paper read at the recent meeting of the Society of Naval Architects and Marine Engineers.

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in shipbuilding even small additions and changes in minor features often lead to considerable modifications in the end. *It would therefore appear desirable that, given a well thought out and carefully considered design, as every warship design should be, no changes whatever, except to correct actual mistakes, should be made during construction tending to change any single feature of the design, this for the purpose both of insuring rapid construction and of getting the real maximum efficiency from the design.*

The criticism of any ship, merchant or warship, may only justly be made after a careful consideration of the state of knowledge at the time of her design, as naval architects, like the member of any other profession, have only the human gift of foresight, and the criticisms often seen and heard of vessels whose designs are some years old, made in the light of later knowledge are not always just.

Peace-time investigations and experimental work on engineering work and ordnance material are necessary, and in warships, as in merchant ships, lead to practical improvements of immense value irrespective of further development of knowledge gained in actual war. To them are mostly due the actual improvements in ordnance, armor, and engineering materials, but actual war experience is necessary to point the way and to demonstrate that the peace-time developments are useless and should be altered or omitted, or that they are of value and should be further developed. Long continued periods of peace tend toward the multiplication of peace-time fittings and the magnification of the value of such things, and it is a problem of no mean moment to provide the requisite habitability and comfort necessary to ordinary use without serious injury to the features imperative in time of war. Therefore, while perhaps a somewhat trite and obvious statement, one of the principal problems of the military naval architect is that he has to be continually on the lookout for the results of naval wars and maneuvers, generally difficult to obtain, and to sift out, weigh carefully the results of these and make suitable deductions from them, generally in the face of conflicting deductions by those who use the ships, in order to properly incorporate in future designs the necessities developed in such wars and maneuvers, or to eliminate or modify features already existing and which have proved undesirable.

Often the high development of one feature of a warship's design has rendered inadvisable the continuation of another feature desirable in its original inception, as in the case of the ram, which is now gradually disappearing, due to the high development of the gun.

The purely sea-going qualities of seaworthiness, stability, strength, and maneuvering in an undamaged condition, can, in general, be better developed from peace-time considerations than from those of war times, as there is more time available both to the sea-going and technical branches to consider and investigate these subjects and the results of their previous efforts.

Even these somewhat elementary features of design are, however subject to rude shock when the vessel (as continually occurs in war) receives an unexpected damage, and the possibility of such damage, based on what has happened and the engines and implements of war prepared for causing such injuries to war vessels by various countries, require the most thorough thought, experimentation and investigation in order to be properly guarded against.

It is somewhat difficult to determine a starting point for this paper, the design of warships, with the problems involved thereby having continued over so many centuries, and because so intimately connected with the changes in design are the changes in material.

With the older shipbuilding materials of wood, and even iron, the present development would, of course, have been impracticable, while the introduction of steel and the progress made in its manufacture and the improvements in engineering methods and materials have made it feasible.

In the U. S. service, the present modern navy dates from the early 80's, when the United States built a number of cruisers of varying characteristics, but, with the exception of the completion of the old monitors, built no armored ships. Practically all the ships of the present navy have been built within what may be called the period of steel.

The Maine and Texas (1890-1895) represent our earliest vessels of the battleship class, though the Maine was later rated as an armored cruiser, but they were based on foreign designs. It is believed to be correct to state that at this time the American opinion as to naval design was in the formulative stage as to the requirements of armorclads for the first line of battle, and we naturally turned to the experience of those foreign powers possessing armored fleets, the designs of which were based on more recent experience with modern ordnance than that of our Civil War.

Public opinion as to the desirability of a construction policy for the navy, and as to what this policy should be is largely non-existent in this country, whereas in other countries it is, at times, the compelling factor in determining on such conditions and even has a marked effect on the type of ships. The English Naval Defence Act of 1889 was decided on largely, if not wholly, because of public opinion, and against the wishes, to some extent, of the Admiralty. Such a condition has never existed in this country, to the writer's knowledge, and yet its absence, in some respects, renders easier the problem of naval design in leaving unhampered those trusted with the design of ships, though the popular enthusiasm on naval subjects cannot but result beneficially to the material, as well as to the personnel, of the navy.

Our first "native" battleship designs, the Indiana class, represented, it is generally conceded, a very high order of development in warship design at the time, and with due respect to the high order of technical ability preceding and leading up to those designs, the writer may best confine this article to the period since the time of the designs of those vessels.

Not unnaturally, after the years of development and use of sailing ships, the natural conservatism of man and one of his saving qualities, caused the retention of many of the features of such ships, perhaps a surprising number, considering the state of development of the armorclad.

Originally this conservatism extended to the external form and the retention of sails themselves, in addition to the steam-power, which no argument of the naval architect could induce the sea-going officer to abandon, but that had disappeared for ships of the line at the date of the Indiana class, and the present day eye is not seriously offended by radical departures in external appearance even from the immediately preceding design, so that this particular difficulty of the naval architect may be said to have disappeared before the beginning of the period reviewed.

As the necessities of modern ships have in many cases caused the development of new means for accomplishing results, this spirit of conservatism has often resulted in the duplication of fittings for the same purpose and while perhaps not exactly a problem in the technical sense, it has been in some senses an important one, though of decreasing moment in each successive design.

At all times in the design of warships of the battleship class, a considerable portion of the total weight has been devoted to defensive arrangements. This has taken the form of vertical, horizontal, or inclined armor, whose relative merits have been so ably discussed by Captain Hovgaard. This armor has further been subdivided into protection (1) for buoyancy and stability, and (2) protection to the armament, ammunition and personnel.

Some foreign services, notably the French and Italian, have at times devoted a preponderance of the defensive

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weight to the second purpose, and from the varying opinions as to the best purposes of armor has arisen one of the important problems of design.

It is now generally conceded, and has always been followed in the U. S. designs, beginning with the Indiana class, that the first purpose is the more important, as probably affecting the life of the whole ship, and that armor, when properly distributed for this purpose, generally incidentally contributes largely to the second purpose.

At various times in the course of battleship design, striking examples have occurred of the weight given to the rival claims of offense and defense, at times the one having the preponderance and at other times the other, and the naval architect's design has naturally been largely influenced by the prevalent naval opinion as to the relative merits of these two features.

The U. S. battleships have generally shown a well-considered adjustment of the two qualities necessary to all-round efficiency, with a general acceptation of the belief that a well-armed and handled ship has within herself a mighty protection apart from such actual armor as may be given by the designer.

The construction of any class of vessels, apart from changes in opinion as to qualities desirable in a warship, necessarily demonstrates deficiencies in the details of the design which require to be overcome in the succeeding designs.

The Indiana's dimensions and battery are given in the appended plate, and the principal inherent defects in the design were due to her original avowed object of coast defense—a style of naval warfare to which, it is believed the strategical experts now consider a sea-keeping fleet is best suited. For this purpose of coast defense, as outlined in its original inception, she has never been used. The inherent deficiencies referred to were small radius of action, low freeboard and slow speed, and accordingly, as a purely peace development, in the succeeding or Iowa class these features had to be and were improved upon, the radius of action by increasing the bunker capacity, the low freeboard by adding an additional deck forward, and the speed by a considerable increase of horsepower, from a designed H. P. of 9,000 on the Indiana to 11,000 on the Iowa, giving a designed speed of a knot more.

One of the practical results of the construction of the Indiana class was finding that turrets of the unbalanced type, carrying large guns, produced, when trained abeam, an undesirable heel from which arose the development of the present type of overhung or balanced type. The present U. S. type of turret, with its sloping front plate, is the process of evolution through several intermediate steps, but is primarily due to the experience on this ship. The matter of installation of heavy guns is one of the principal problems which has confronted the designer of warships, the English clinging to the nomenclature (at least) of the barbette type, and the French and U. S. navies to the turret type, both of which, however, as in many other features, have changed in such manner that the two types are now very similar.

In the matter of installation of smaller guns where fitted, there has also been difference of opinion.

We have never in our service mounted guns less than 8 inches in turrets, while the French have fitted those of much smaller caliber in turrets.

The U. S. designs have therefore in this respect generally represented a mixture of the so-called English and French ideas.

The writer is of the opinion that for the majority of duties of the battleship, which is essentially for fleet purposes, involving operations such as to make great broadside fire desirable, the broadside installation for intermediate calibers produces a maximum result with a minimum expenditure of weight, utilizing in great part, as it does, for protection of the guns the weight already assigned to the protection of the ship herself.

The overcoming, or at least, the amelioration of the difficulties experienced in our first class of battleships necessitated an increase in size from 10,225 to 11,363 tons, and an increase in length from 348 to 360 feet. About this time an improvement in the ballistic qualities of armor permitted a reduction in its thickness, the Indiana's side armor being 18-inch top and 8½-inch bottom, and the Iowa's 14-inch top and 7-inch bottom, with equal protection and an increase in area of protection on about the same weight, thus somewhat simplifying the problem. The increase of bending moment resulting from the greater distance between barbettes necessitated some modification in the structure, but the change necessary was not of sufficient moment to render the problem of the structure itself difficult, and practically the whole of the additional displacement gained by increase of size was available for the additional load of upper deck, additional area of armor, extra length of hull of about same scantling, coal, and machinery.

The Iowa has been a very successful ship, and still represents a formidable unit though her armament is naturally somewhat antiquated.

In the immediately succeeding designs, Kearsarge and Kentucky, may be seen the effect of naval opinion as a development of theoretical and peace-time considerations, particularly in the arrangement of battery and the superposed turrets, it being argued at the time that the tactical advantages of this arrangement of battery were great, even considering the decrease of freeboard necessary to obtain it.

Contemporary literature shows many arguments both for and against the superposed turrets, and these arguments continued for some years, as evidenced by the Virginia class of battleships (1900-1905). It is now granted, the writer believes, by those most conversant with target practice and the use of guns, that other distributions of guns are better. Here in the Kearsarge and Kentucky was another problem confronting the designer in providing structural strength to support the immense weights of turrets (weight of Iowa's turrets was 463 tons; of Kearsarge and Kentucky, 728 tons each) and taking the recoil of the turret guns, as the trunnion pressure for simultaneous firing increased from 220 tons to 506 tons, and to provide at the same time the necessary metacentric height, etc., with the high weights, which combined to necessitate the return to the low freeboard and thus impaired the dryness of the vessels at sea.

The design succeeding this, the Alabama class, shows a general similarity to the then prevalent type of English battleship, and with the knowledge gained by previous ships, presented no unusual designed problem beyond the general one of the development of the details to obtain a proper balance of qualities.

In battleships, as well as in wearing apparel, there is often apparent the effect of style, though style in ships is generally due to consideration of the kind of warfare in which they are to engage and the contemporary line of development of ordnance, gunnery, and tactics, the changes in style being due to changes in one or more of these.

At times a considerable similarity has existed between our battleship and the prevalent English style, and at other times this similarity has approximated more closely to the French. The writer does not wish to be understood to imply that this was done from a desire on the part of any nation to follow the practice of any other nation in warship design, but that the prevalent naval opinion as to the strategical and tactical qualities necessary being similar in two countries, or the geographic, hydrographic, or political positions of two countries being similar, naturally leads to ships of generally similar qualities and appearance. This is strongly borne out by the present tendency of all nations who can afford the price to construct large ships with great speed and a main battery of a single large caliber of guns.

One of the most difficult problems confronting a designing naval architect is

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that of keeping pace with and properly considering the rapid changes in naval opinion, which is generally, it is true, based on experience, but sometimes on prejudice, pure theory, and made popular by the ready pen of the advocates.

In the Maine, designed in 1898 and of the same general type as the Alabama, the demand for additional speed, with the increased weight required to produce it, necessitated an increase of length of the 368 feet to 388 feet, and involved an increase of stress requiring careful consideration of the structural arrangements which proved somewhat different from preceding designs. Here again, the improvement in ballistic qualities of armor came to the assistance of the designer, but the increase in the power of guns since the previous design presented a problem of much difficulty to obtain in the foundations of turrets and guns, satisfactory supports for the enormously increased recoil moments over those previously experienced, due to the increase of muzzle velocity made possible by smokeless powder and improved design. The trunnion pressure of the 13-inch guns of the Alabama was 192 tons per gun, while that of the Maine 12-inch guns was 338 tons; the trunnion pressure of the 6-inch guns of the Alabama was 45 tons, and that of the Maine 70 tons.

At this juncture occurred the Spanish war, and while in the sense of affecting ideas on naval design it did not teach all that could be wished, it developed many ideas. As a result of this war, the 8-inch gun abandoned on the two previous classes again appeared in our designs (the Virginia and Connecticut classes), but as the superposed turret was still in favor, they appear in the Virginia. It would appear that the return of the 8-inch guns was to some extent due to the fact that the gunners using them during the Spanish war could shoot better than those using the 12-inch and other calibers, though the writer is aware that many officers have a different idea.

The Spanish-American war, in the battle of Santiago and also of Manila, demonstrated the necessity for the elimination of wood from ships in every place possible—a belief which, however, the more progressive countries had held prior to that time. This particular problem was solved by the substitution of linoleum for wood as a deck covering, steel for wood divisional bulkheads, and in some cases of steel for wood in the manufacture of furniture, and the general reduction of wood fittings where liable to combustion or splintering. So far, in our own service, no satisfactory coating for weather decks other than wood has been found, though in some foreign services the elimination of wood has been carried even to the removal from weather decks. Fireproof wood was employed in a number of the U. S. vessels, but owing to its unfortunate quality of injury to fastenings, difficulty of finishing with paint or varnish, and other drawbacks, has been abandoned.

Further increase of speed also appears in these designs and high freeboard for sea-keeping, and the additions to battery, area of protection, and horsepower necessitated the further increase in size shown by reference to the plate.

The adoption of smokeless powder, for various reasons, little as the change would at first glance appear to affect the work of the naval architect, has introduced directly and indirectly several difficulties; directly in that it requires low temperatures in the rooms in which it is stowed, thus complicating the stowage arrangements, ventilation, and other arrangements for reducing temperatures; and indirectly, in the increase in ballistic qualities of ordnance, necessitating increases in turret and gun foundations and increased weight of armor necessary to provide the proper protection, and this alone would have made progress along the lines of armored battleships impossible but for corresponding improvements in the armor itself.

The improvements in ballistic qualities made since the beginning of armor manufacture are large, and even since the date of the Indiana class, originally designed to be fitted with plain nickel steel armor, but later fitted in part with Harveyized armor, have been marked.

Taking 15 inches of iron as a standard thickness, the same defense could be obtained with 12 inches of compound or ordinary steel armor, 7½ inches of Harveyized, or now with less than 6 inches of the latest Krupp armor.

Had it not been for this improvement in armor, the naval architect would have found it quite impracticable to provide the area of protection to buoyancy and stability and personnel that are now universally conceded to be necessary in view of the quick-firing guns and high-explosive shell now in use, which rapidly and entirely destroy the structural work not protected by armor, as shown both by the Spanish-American and Russo-Japanese wars.

The improvement in ordnance coincident with the improvement in armor, however, has in turn necessitated the increase of protection to such an extent that the problem is still difficult, although the thickness of armor of from 10 inches to 12 inches, generally found in present day designs, equals in protection qualities about 25 inches to 30 inches of iron.

The coaling of warships, which, within the last twenty years, has been recognized as one of the important qualities in a vessel, is another problem which has engaged the attention of the designer and constructor in an endeavor to make the operation rapid and efficient. This problem is divided into two broad divisions, one coaling at sea under way, and the other coaling when at anchor, and may be further divided into:—First, getting the coal from the collier to the ship; and, second, from the deck to the bunker.

As to the coaling at sea, it has engaged the whole attention of several experts, who have solved it more or less satisfactorily, though much remains to be accomplished in this line.

As to the coaling in port, we have here also many varying opinions. The English service use the Temperly transporter, while in the U. S. service we have confined our efforts to booms and stays overhead for getting the coal to the deck, and while good records have been made with the devices when properly installed and handled, most of the delay that has been experienced has occurred in getting the coal to the bunker.

To the best of the writer's belief, the principal criticism of the present overall coaling system in use in battleships and armored cruisers in the U S. service is that it is dirty. There is yet to be discovered a method of handling coal that does not involve dirt, and considerable dirt.

The increase in armored areas of sides has prevented the use of the side ports common in merchant ships and necessitated coaling over-all.

The fitting of through trunks with the box-battery system is generally not permissible as causing interferences with the battery, hence the necessity for portable trunks, or for handling the coal on the gun deck and thence distributing it to the bunkers.

By landing on the gun deck and distributing, the ship, if properly arranged, may be coaled on both sides from a barge or lighter on one side—a process impracticable with all chutes carried to upper deck where the vessel has a superstructure and numerous deck erections, as most of our ships have.

Following the Virginia class of battleships come the Connecticut class, Vermont class, and New Hampshire class, all in essentials the same, but wherein the increase in battery power demanded over the Virginia, the 12-inch and 8-inch guns being same in number and twelve 7-inch being substituted for the twelve 6-inch, and the improved protection necessitated by improvements in ordnance, caused an increase in displacement from 15,000 to 16,000 tons—an increase which would have been greater but for the information gained from the experimental model basin permitting a design giving the 18 knots speed on a less horsepower

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than would have previously been possible.

No attempt is made to comment at length on the problem of ships' forms and propeller design, which are perhaps the principal problems of the naval architect, as that has been so well treated in various papers by those best able to discuss it. Needless to say, the results of the model basin, both in this country and abroad, are such that without them the other problems would probably not be capable of solution at all.

After the New Hampshire design, ideas and developments came thick and fast. In the first place, due to the knowledge gained by modern target practice, for which credit in this country is due to Lieutenant Commander W. S. Sims, U. S. N., the rates of fire of guns were so increased as to make the necessity for carrying greater supplies of ammunition —a necessity recently borne out by the experiences of the Russo-Japanese war. It also necessitated more rapid delivery from magazines to guns, with the apparatus necessary to do it.

Then the opinion that the large guns of a vessel should be all of one caliber, which facilitates concentration of fire, permits redistribution of ammunition when the supply of one or more guns is running low and has other advantages, such as greater range, flatter trajectory, and great smashing effect at long ranges, and if this is what is wanted, it in some respects simplifies the design in the matter of the stowage and handling arrangements for ammunition.

From such information as has been received as to the damages experienced in the Russo-Japanese war, the writer is of the opinion that the entire abandonment of the intermediate calibers is unwise, considering the rapidity of fire that can be maintained with guns of 5-inch, 6-inch, and 7-inch calibers, and the immense damage that can be done to the upper works and unarmored areas of a ship's side, which must, for years yet, be considerable in extent.

The writer further believes that there is already a visible tendency to increase the torpedo defense battery in caliber, so that it will, within a few years, occupy its old position of an intermediate caliber to be supplemented by other and smaller guns.

The development of the automobile torpedo to its present high range has reopened the question of installing these in battleships with submerged tubes, though judging by experience, the effect is more moral than actual.

The development of fire-control requirements so that the battery may be controlled in a manner not heretofore customary, is a problem with which we are now dealing and which, simple as it may sound, is of considerable difficulty in providing the elevated observation stations and the complicated systems of interior communication necessary to the accomplishment of the object, at least in the manner at present intended.

The necessity for slow and continuous rates of train of turret installations to permit the present system of continuous-aim firing, and the necessity for installation of guns at great heights above the water-line in order to permit their use in all kinds of weather, are two problems now receiving much thought.

The question of the necessity for extreme speed in armored vessels is one on which there has been much discussion and one on which opinions still vary widely; but if, along with the other present day requirements of a large number of heavy guns, large quantities of ammunition, great protection to personnel and stability, the requirement of great speed is to be added, it will be seen how complicated becomes the problem of the whole design.

The problem of speed, like the problem of protection, would be impossible of solution but for the improvements made in the means of obtaining it. The most important remaining factor of the speed problem is the design of propellers to the solution of which so much has been contributed in this country by Naval Constructor D. W. Taylor, U. S. N., and Professor W. F. Durand, and abroad by Mr. Barnaby, Mr. Froude and others.

The development of the turbine, now in its infancy, will doubtless contribute further to the solution of the speed problem, which at present occupies so much attention.

In brief, as applied to warships, the problem of speed seems to be:—Given opposing squadrons of equal radius of action, armor, and armament, would an excess in speed of two to three knots, purchased at great cost of money and handiness, and at the possible cost of fewer ships, enable an admiral (1) to force action? (2) If it did, would the two knots speed, other things per ship being equal, enable him to win? Or (3), would it enable him to escape action which, the offensive and defensive qualities being the same, he would probably not want to do?

The answer to this problem is one on which the best informed do not agree.

In the last Brassey's Naval *Annual* a whole chapter is devoted to the pros and cons of the subject, such eminent authorities as Sir Cyprian Bridge, of the Royal Navy; Commander Daveluy, of the French Navy, and M. de Lanesson, taking sides against extreme speed, and other equally eminent authorities taking the side of high speed.

A recent article in Blackwood's *Magazine*, by Black Joke, is a good example of the arguments that sea-going men can produce against it.

The writer's opinion, after careful study and reading, is against excessive speeds, and he agrees with M. Ferrand, an eminent French engineer in largely basing his opinion on the excessive cost of ships, since if we are to combine with the present demands for large armor and armament, great speeds, we will have a cost per ship which must necessarily reduce the number of ships which could be otherwise built with equal armor and armament and radius of action and with only a slightly less speed, and one that some eminent flag officers agree would not be so small as to injure the maneuvering tactical qualities.

To accomplish the ends of great speed, heavy armor and armament, and to include such results as were known at the time to be desirable from the Russo-Japanese war, the English Admiralty prepared the Dreadnaught design, whose essential features are now well known. These include a battery of single large caliber of guns, with no other caliber except small torpedo defense guns 3-inch caliber; a speed of 21 knots; the practical abandonment of the ram, which, due to the increase of range of battery and torpedoes, is now believed undesirable; and, while not a result of the Russo-Japanese war, the use of turbines. While some of the features of the design, particularly in the arrangement of battery, seem to be open to question, as not obtaining the most desirable distribution of fire of the battery carried, the results have certainly been remarkable, particularly so in evidencing what can be done in rapid ship construction where no changes in design from the original are permitted, which the writer has been reputably informed is the case.

At the time of the consideration of the Dreadnaught's design, there was already in existence an Act of Congress providing for the construction, for the U. S. navy, of "two first-class battleships carrying the heaviest armor and most powerful armament for vessels of their class, upon a maximum trial displacement of not more than 16,000 tons; to have the highest practicable speed and great radius of action, and to cost, exclusive of armor and armament, not exceeding four million four hundred thousand dollars."

It will be noted that the Act limits the displacement to 16,000 tons.

On consideration it will appear how much of a task is imposed on the designer when, in addition to the limitation of cost, is put a limitation of displacement, and that the results that can be obtained must necessarily be limited thereby. In a case such as this he is between two fires—the necessity of conforming to the laws, and the desire, in

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response to naval opinion, to put three pints in a quart cup.

After careful consideration of the features desirable, and considering the necessity for strict conformity with the law, the designs of the South Carolina and Michigan were evolved

The writer is of the opinion that, at some periods in all services, too much consideration has been given in design to the development of characteristics tending to efficiency in individual ship action, to the detriment of a corresponding efficiency in squadron or fleet action.

This has doubtless been due to lack of proper knowledge available as to squadron or fleet maneuvers—a knowledge recently much augmented by the naval maneuvers conducted by different countries, and by the experience gained in the Spanish-American and Russo-Japanese wars.

The attainment of the desired results in the South Carolina and Michigan could only be reached from a most careful consideration of all questions, and the elimination of such features as were considered least tending to fighting efficiency under the conditions in which they might naturally be called upon to act. These considerations led to the arrangement of battery shown in the belief that broadside fire through a considerable arc from bow to stern was of vastly more moment in fleet action than volume of fire ahead or astern. It seems to be generally conceded that this deduction is correct.

The increase in weight of the structure necessary to provide against a large increase of stress due to the location of turrets was considerable. The hull weight, as compared with previous designs, may be seen from the curve. The raising of the weights vertically higher than had been the practice on ships of similar design necessitated increase of beam to provide the necessary stability. An exhaustive series of model experiments was conducted, resulting in obtaining a model giving, on the same horsepower, a considerable increase of speed over that obtained on previous ships of same length and displacement, although on the limited displacement it was not attempted to provide for a speed as high as the Dreadnaught's.

The results of the Russo-Japanese war have indicated how serious may be the results of torpedo and mine damage, the Japanese having lost by mine the Hatsuse and Yashima, with several smaller vessels, and the Russians the Petropavlovsk, Boyarin, Yenesei, and several smaller ships at Port Arthur; and the Russians having received severe injuries on Sebastopol, Pobieda, and Bayan by mines, and on Pallada, Retvizan, Tsesarewitch, Bevoi by torpedo, putting these ships out of service for considerable periods at a time when their services were most needed. It, therefore, becomes one of the most serious problems of the designer to provide against the fatal results of such explosions.

From such accounts as are available as to the damage to under-water hulls by mines and torpedoes, it appears that, when in contact, the explosion of a mine of the Japanese type has sufficient force to pierce the shell the inner bottom, and in many instances the longitudinal coal bunker bulkhead inboard where located in what may be called the conventional place and manner.

Two experienced naval architects, Mr. W. A. Dobson in this country and Sir E. J. Reed abroad, have independently evolved schemes of protection against such damage by the fitting of interior armor below the water-line in such form as to limit the damage.

The only argument that one can present against this scheme is the weight involved, and when this becomes prohibitory from the effect on the other qualities necessary other means must be adopted.

The most recent U. S. design, it is believed, safely provides against a fatal result of any damage other than the complete demolition of the underwater hull by a suitable arrangement of transverse water-tight compartments, the arrangement of longitudinal bulkheads and platforms so as to give three skins between such damage and any explosive carried by the vessel, or any compartment of sufficient size to endanger stability.

The most careful thought was given to protection against such damage on these designs, and while any such protection must be expensive in that rarest of commodities to the naval architect, weight, it is believed that the desired object has been obtained.

A purely peace-time development, and one from which, after considerable observation and reading, the writer believes that the U. S. designer suffers more than any other, is the multiplication of luxuries, such as considerable quantities of steam heat, peace-time hospitals, bathrooms and washing arrangements with hot and cold water, elaborate messing arrangements, laundries, sheathings, elaborate hospital spaces, cold storage—items which are daily increasing in number and weight to the great hampering and natural injury of other features

The writer appreciates that it is said against the designer who criticises the increase of such luxuries that he does not have to suffer from their omission, but believes it would be astonishing to the average person to show the immense weights taken up in such things, and the sacrifice in the other, and in war time more desirable qualities of a vessel of war necessitated thereby.

During the last session of Congress, impelled, no doubt, by the design of the Dreadnaught and the laudable desire that the United States should not be behind any other power in preparations for her national defense, Congress passed an act providing:—

"That * * * the President is hereby authorized to have constructed * * * one first-class battleship, carrying as heavy armor and as powerful armament as any known vessel of its class, to have the highest practicable speed and greatest practicable radius of action and to cost, exclusive of armament and armor, not exceeding six million dollars; * * *"

It will be noted that the only limitation here is one of cost.

In this respect the problem becomes more easy of solution.

The legislative body naturally and properly limits the expenditures for naval purposes, hence one of the largest problems confronting the designer is that of cost, and a continual effort must be made to simplify the details of construction, to reduce unnecessary items to a minimum in order to prevent exceeding appropriations. In this, however, his work is not essentially different from merchant designs, where the designer must so draw his design that the owner's money is not wasted.

The Bureau of Construction and Repair, where the writer is on duty, has been engaged on the preparation of the department's designs for these ships, but as they are to receive the consideration of the department and Congress, together with the designs of any other naval architect of standing, before decision is reached as to the one finally adopted, he is not at liberty to discuss the features of the design.

It is pertinent to say, however, that the necessities of the case as to the amount and concentration of gun-fire, protection, and speed, have combined to produce a problem difficult of solution in providing along with these, in satisfactory measure, the necessary strength, stability, and maneuvering qualities in damaged condition which may not unlikely obtain when she is called upon to engage in war.

It must be continually borne in mind by the designer that his vessel requires to enter dock at intervals to permit of her continuing in efficient condition for service. He is therefore necessarily limited by the size of the docks she is to enter, and is further limited in draught by the draught in harbors which she will in all probability be required to enter.

This seems a somewhat backward way of working it, as it would seem more logical to construct the docks to fit the

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ships. Here, too, however, the question of foresight comes in, and it would hardly do to construct a fleet of warships which no dock at the command of a country, or one dock only, could accommodate, and it is not always possible to obtain the money to construct new docks on demand, or feasible to enlarge the existing ones.

Many prophesies have been made as to the size and characteristics of battleships of the future, most of them taking a view that such vessels will be only limited in size and power by the ability of the country desiring them to pay the necessary price.

Naval Constructor Laboeuf, of the French Corps of Naval Constructors, in a series of articles that have recently appeared in *Le Yacht*, is of the opinion that the prophesy of Colonel Cuniberti at the International Congress of Naval Architects, in 1900, as to the probable fusion of the battleship and armored cruiser, has already taken place in the Italian Roma and the English Dreadnaught, and predicts that the displacement of the battle cruiser will reach 25,000 to 26,000 tons or more, by 1915, at a cost of from $12,000,000 to $13,000,000. This seems not improbable when we consider that in the merchant service, the Etruria of 1884 displaced 12,000 tons, while the Lusitania of 1906 displaces 40,000.

He draws attention to the fact that the calibers of large guns have been decreasing in the United States from 13 inches to 12 inches, and abroad from 16 inches to 12 inches and even 11 inches, and that of the smaller guns increasing from 6 inches to 7 inches and 8 inches in the United States, and abroad to 9.2 inches and 10.4 inches, and that the material result of this converging tendency of the size of guns is that there should be a single caliber of large guns.

It has been stated above that this condition already obtains on the Dreadnaught and Michigan classes. It also obtains in the Japanese Satsuma of 19,500 tons, and it is believed in the new German designs, where it is said to be in the form of sixteen 11-inch guns. The British armored cruiser Inflexible has eight 12-inch guns.

M. Laboeuf suggests a design for this prophetic ship of 624′ x 98′ x 27.5′ with eighteen 12-inch guns in two-gun turrets, giving twelve ahead, ten astern, and twelve abeam.

Whether or not this ship or one of similar size is the ship of the future remains to be seen.

It is not impossible nor improbable, though the discovery of some new engine of warfare might upset the present tendency of warship design; but whatever the ship of the future is to be, we may rest assured that it will present problems of equal or greater moment than have confronted us in the past.

The development of types other than battleships also presents problems of no little moment to those of us in the naval service.

In torpedo-boat work the small craft of the early 80's, has, in our service at least, been almost totally supplanted by the so-called destroyer, whose function originally intended to be, as the name implies, the destruction of the smaller torpedo-boat, is now about the same as the original function of the torpedo-boat, with the added quality of considerable sea-keeping power.

The destroyers built by the United States from 1898 to 1902, so far as may be determined by peace-time use and maneuvers, have proved very successful and satisfactory boats.

As our torpedo-boat building program has been a spasmodic, rather than continuous, nature, it is difficult to trace progress and the problems in development occasioned thereby.

In general, the progress in such boats has been due to desirable increases in size, and while this country so far has not tried for the high speeds which we read of as employed by some foreign nations, it is probable that there will be considerable development along this line also.

In the Russo-Japanese war the danger of damage to such unprotected craft was made so apparent that there has in certain quarters, arisen a strong advocacy of gasoline-driven boats, with engines of the motor-boat type for this purpose, and it is not improbable that such boats will be built before long of considerable size, the English having already developed small craft of this type.

The development of the scout type of warship, of which we now have three building, is an interesting example of the difficulties confronting the naval architect.

Here, on a displacement of 3,750 tons, and a length of 420 feet, is obtained a speed of 24 knots and coal capacity of 1,250 tons. Any such combination taken, as it is in connection with a battery of two 5-inch, ten 3-inch and two 21-inch submerged torpedo-tubes and a side protection of 2 inches, necessarily implies a reduction of hull weights, and in view of the length required, a careful arrangement of the structure to withstand the stresses to be expected in a seaway.

The problem of the submarine is one that has grown to some proportions. So far as confined to the submarine itself, it has in this country been undertaken by private concerns and individuals, but has had its effect on the design of other craft, and if its speed can be developed to a higher point, will become even a more formidable engine of warfare than is now the case.

PRESENTED TO PRESIDENT LIVINGSTONE.

President William Livingstone of the Lake Carriers' Association, was presented on Saturday last with the punch bowl which his associates, the members of the board of directors of the Lake Carriers' Association, voted to give to him while at the annual meeting at Detroit two weeks ago. At that time THE MARINE REVIEW stated that the association was thus honoring its president, but the bowl was presented by the board of directors as individuals and as a mark of their personal affection. The bowl is of sterling silver and is engraved with the following inscription:

PRESENTED
JANUARY 10TH, 1907,
TO
WILLIAM LIVINGSTONE,
PRESIDENT,
AS A TOKEN OF APPRECIATION AND ESTEEM
FROM HIS ASSOCIATES,
THE MEMBERS OF
THE BOARD OF DIRECTORS
OF THE
LAKE CARRIERS' ASSOCIATION.

H. COULBY,	C. W. ELPHICKE,
J. H. SHEADLE,	W. H. BECKER,
D. SULLIVAN,	JOHN CRAIG,
H. D. GOULDER,	JOHN E. PAYNE,
W. A. HAWGOOD,	G. A. TOMLINSON,
H. S. WILKINSON,	JOHN MITCHELL,
F. W. SMITH,	A. B. WOLVIN,
EDWARD SMITH,	J. C. EVANS,
J. C. GILCHRIST,	G. L. DOUGLASS,
JAMES CORRIGAN,	J. E. UPSON,
T. T. MORFORD,	C. A. EDDY.

PROMOTION FOR THOMAS DURKIN.

Thomas Durkin, who has been a chief engineer for a number of years in the fleet of the Cleveland-Cliffs Iron Co., and who brought out last year the steamer William G. Mather and the steamer J. H. Sheadle, has been appointed fleet engineer of all the steamers of the Cleveland-Cliffs Iron Co. and steamers of allied interests managed in its office. The fleet engineer will exercise general supervision over the machinery department.

M. A. Bradley, of Cleveland sold the steamer Alva last week to Thomas J. Prindiville of Chicago. The Alva was the only steel vessel in the Bradley fleet. She was built by the Cleveland Ship Building Co. in 1893 and is 324 ft. keel and 42 ft. beam.

Mr. Stanley Morton has been elected president of the Graham & Morton Transportation Co.

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PACKAGE FREIGHTERS SOLD.

Negotiations for the purchase by the Mutual Transit Co. of Buffalo, of the fleet of package freighters owned by the Lower Lakes Steamship Co., were concluded this week. The Lower Lakes Steamship Co., of which Mr. R. R. Rhodes of Cleveland, is president, operated the steamers Huron, St. Paul, Minneapolis and Wm. Castle Rhodes. The price paid for these steamers is not given out. The stockholders of the Lower Lakes Steamship Co. are Robert R. Rhodes, Wm. Castle Rhodes, Robert Wallace and James C. Wallace of Cleveland, and Edward Smith of Buffalo. The Mutual Transit Co. which has acquired these steamers has been operated only about five years. Its organization was a sequel to a pooling of issues by the New York Central, Lehigh Valley, Erie and Lackawanna Railroads. Mr. C. M. Heald is president of the Mutual.

AROUND THE GREAT LAKES.

Capt. R. W. England is in Buffalo superintending the release of the steamer G. J. Grammer.

Capt. John Mitchell of Cleveland, left for California this week, for a vacation of about a month's duration

The grand lodge of the Ship Masters' Association is holding its annual meeting at Toledo this week.

The Detroit River Transit Co., of Detroit, will rebuild the steamer Desmond and convert her into a sand-sucker for general dredging and harbor work.

The shear legs at the Bay City yard of the American Ship Building Co. were thrown down in the recent wind storm, but fortunately no damage was done.

Capt. Henry Judson, of Cleveland, died recently. He was at one time steamboat inspector for the Cleveland district and had sailed for years in the Bradley fleet.

The steamer building at the Wyandotte yard of the American Ship Building Co. for Mr. E. D. Carter of Erie, Pa., will be named after J. H. Bartow, of Cleveland.

The Detroit & Cleveland Navigation Co. has just issued a New Year's greeting in the form of a compass calendar, whereby any traveler may shape his course during 1907.

The Great Lakes Towing Co. will move from the seventh floor of the Western Reserve building to the fifth floor of the Rockefeller building in a few weeks. Their present offices in the Western Reserve building will be absorbed by Pickands, Mather & Co.

The officers' quarters on the upper deck of the Anchor Line steamer Tionesta are being removed at Detroit and in their place six commodious parlors, each with a private bath, will be installed. This work is being done by the Vinton Co. of Detroit.

Walter J. Graves, since 1898 in the United States survey office at Detroit, has been transferred to Sault Ste. Marie where he will assist in the design and construction of the new lock under Col. Charles E. L. B. Davis. He will be under the immediate supervision of Supt. L. C. Sabin.

Mr. T. R. McCarthy, of 504 Board of Trade building, Montreal, has been appointed Canadian agent and freight broker to the New York and Continental line (incorporated). This line will operate a regular weekly service of first-class freight steamers between New York, Hamburg and Rotterdam. The first boat from New York will be the Tropic, sailing about Feb. 2; the second will be the Lord Erne, about Feb. 9, with the Tronto and Lord Downshire to follow.

The firm of Rispin & Maytham, general weighmasters at Buffalo, N. Y., has been dissolved. The business will be continued as heretofore by Mr. R. E. Rispin and Capt. K. Pederson under the firm name of Rispin & Pederson. Both of these gentlemen are well and favorably known by the majority of vessel owners on the great lakes, and look to their many friends to assist them in making the business of the new firm a success. The offices of the new firm are located at 200-202 Main street.

Gilmore's dry tock at Toledo, just below the Wheeling & Lake Erie bridge, probably the oldest dry dock in the port, is quite busy this winter with repair work which is just suited for this sized dock. The sandsucker Commerce has had new decks, deck beams and a new stem put in, and one of the Great Lakes Dock Dredging & Construction Co.'s dump scows is now being rebult. The Chauncy Hurlbut is also to go in for an overhauling. Abram Gilmore established this dock about thirty-four years ago. It was originally 188 feet on the blocks, but has been lengthened since then to its present length. When the dock was first established there was a good deal of business all along the lakes on account of the wooden boats, but the advent of the steel freighter has sounded the knell of the small docks and work is no longer so plentiful.

ITEMS OF GENERAL INTEREST.

The business men of Long Beach, Cal., have subscribed $100 000 to purchase 32 acres of water front on the inland harbor to be deeded to the Craig Ship Building Co. of Toledo as an incentive for the establishment of a plant there.

Charles Buchanan, for several years principal surveyor, has been appointed to the position of senior assistant to H. J. Cornish, the chief ship surveyor to Lloyds register for British and foreign shipping rendered vacant by the retirement of G. Starbury at the end of last year.

THE MARINE REVIEW has received an inquiry as to where flexible portable pontoons may be procured, or where they are manufactured. What is meant is a pontoon made of canvas, lined or coated with rubber, and capable, when filled with air, of lifting from thirty to forty tons.

Wm. Pigott and James A. Moore have purchased from Schubacher & Hamilton and the Dollar Steamship Co., the bulk of the German steamer Mariechen now lying in Seattle harbor. The Mariechen was wrecked in Puget Sound last year and was taken to Seattle.

A very attractive book entitled *"The Horse,"* which contains suggestions for the proper care of the horse in and out of the stable, is published by the Joseph Dixon Crucible Co., of Jersey City, N. J. This book will appeal to all who own or handle horses and will be sent free to those requesting a copy. Write the publishers at the above address.

The fourth steel freight steamer for the Atlantic & Birmingham Construction Co. was launched Tuesday, Jan. 29, at the works of the Fore River Ship Building Co., Quincy, Mass. The vessel was christened Ocmulgee by Miss A. M. Hill. This is one of four freighters which have been built for service between New York and Brunswick which have a length overall of 312 ft. 10 in., beam molded 40 ft., depth 27 ft. 5 in., and draught loaded 18 ft. The vessels are fitted with triple-expansion engines and two single-end Scotch boilers

The American Ship Windlass Co., Providence, R. I., announces a change of management. Mr. Robert S. Riley has become largely interested and will hereafter assume the active management of the business. Mr. Riley's experience has been large, embracing service at sea both in the navy and merchant marine, and as consulting and superintending engineer ashore including active service in leading ship building plants. For the convenience of customers the American Ship Windlass Co. has opened an office at No. 100 Broadway, New York.

OBITUARY.

John H. Graham, founder of the firm of Graham & Morton and one of the first men to operate passenger steamboats on Lake Michigan, died at his home at St. Joseph, Mich., last week of typhoid fever. Mr. Graham was fifty-nine years old and was widely known owing to his extensive operations in lake passenger trade.

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January 31, 1907.

RETIREMENT OF MR. BURTON.

Hon. T. E. Burton, chairman of the Committee on Rivers and Harbors of the house of representatives, in a speech in the house on Thursday, resigned as chairman of the committee after twelve years of continuous service—that is to say, he announced his ultimate retirement as he does not again desire the appointment of chairman of this committee. This is a circumstance for national regret as no man is better fitted to perform the arduous labors of this office than Mr. Burton. He possesses unflagging industry and amazing grasp of detail—two attributes necessary to success in this office. That Mr. Burton has been a power as chairman of the Committee on Rivers and Harbors is admitted. He has studied the waterways of the United States with greater thoroughness than has probably hitherto been devoted to them. Anybody who has watched his painstaking investigation of every contemplated improvement submitted to him must realize how great a loss it is to the country that such a man should retire from work for which he is so eminently fitted. Mr. Burton has been a consistent advocate of the development of the navigable waterways and a consistent opponent of the expenditure of any money whatever upon waterways that never can be navigated.

LIFE-SAVING SERVICE.

At the annual meeting of the Lake Carriers' Association it was suggested that the life saving service of the great lakes ought to be placed upon a more satisfactory basis. Vessel masters have now taken the subject up through their various lodges and are making an earnest campaign for the betterment of the life saving service. The conditions obtaining in the service on the great lakes are such that desirable and competent men cannot be induced to serve. There is no continuity of employment. Crews are recruited in the spring and discharged in the fall. The captain of every life saving station on the great lakes is compelled to drill a new crew every spring. He cannot secure ordinary seamen, because an able seaman can get better wages on board lake vessels. In fact, it is not an uncommon thing for the captain to discover that the applicant does not even know how to row. It is against human nature that they should become proficient because they all know that in the fall they will be dismissed without pay. It is an arduous task to develop a competent crew from the material which presents itself, and probably if the truth were known, very few of the life saving crews on the great lakes are as competent as they should be—that is to say, competent to render the utmost assistance when it is most needed. The service is, in its essence, an emergency service and is rendered under circumstances of great hazard. Vessel masters are, of course, more interested in the life saving service than any other class of men. They realize clearly the causes which are operating to make it inefficient and are seeking to remedy them. A man who enters the life saving service practically takes his life in his own hands, and if he has a family, leaves them without ultimate support, since there is no pension, no allowance for disability or death, while at the same time no insurance company will take him as a personal risk. What is desired, and what is only fair, is that the crew should be engaged for the twelve months of the year and should be retired upon part pay if injured in the service, or if they have grown old in the service. The various lodges of the Ship Masters' Association are debating the matter and the sense is well expressed in the following resolutions adopted by Detroit Lodge No. 7:

"Whereas, the life-saving service is a most important factor in the saving of life and property in the many disasters occurring from time to time on the great lakes, and

"Whereas, this service is impaired by paying low prices, changing crews every season, and

"Whereas, in case of accident or disability, no provision is made for maintenance of the victims' families and

"Whereas, the men are denied insurance on account of the hazardous nature of their work; therefore,

"Be it resolved, That the Shipmasters' Association, Detroit lodge No. 7 do hereby petition their representatives in congress that measures be taken to present these facts before the honorable body, that some action be taken towards providing pensions or such other measures as will tend to ameliorate the conditions mentioned, and that our representatives in congress be respectfully requested to do what they can to accomplish this end; also, that a copy of this resolution be sent to all sister lodges, asking their cooperation in this matter."

SUB-MARINE SOUND SIGNALING.

The committee of captains of the Pittsburg Steamship Co. is at work formulating a report on the adoption of submarine sound signals on the great lakes. This report will probably be ready to be made public next week. It will recommend certain turning points on the great lakes where submarine signaling could be established to the great advantage of safe navigation. There is scarcely any doubt but that this system of signaling will be generally adopted throughout the entire chain of lakes, as it possesses the merit of unfailing accuracy.

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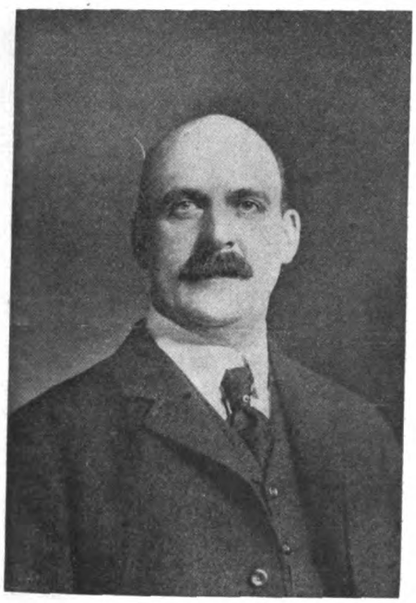
LAUNCHING THE HUGH KENNEDY.

The bulk freighter Hugh Kennedy, building for Capt. John Mitchell, of Cleveland, was launched at the Lorain yard of the American Ship Building Co., on Saturday last, and was named in honor of the general manager of the Buffalo & Susquehanna Iron Co. The steamer was christened by Miss Ruth Kennedy, daughter of the man for whom the vessel is named. The new steamer is 552 ft. over all, 532 ft. keel, 56 beam and 3 ft. deep. She has thirty-two hatches spaced 12-ft. centers. Her engines are triple-expansion with cylinders 23½, 38 and 63-in. diameters by 42-in. stroke, supplied with steam from two Scotch boilers, 15 ft. in diameter and 11 ft. 6 in. long, fitted with Ellis & Eaves draft, and allowed 108 lbs. pressure.

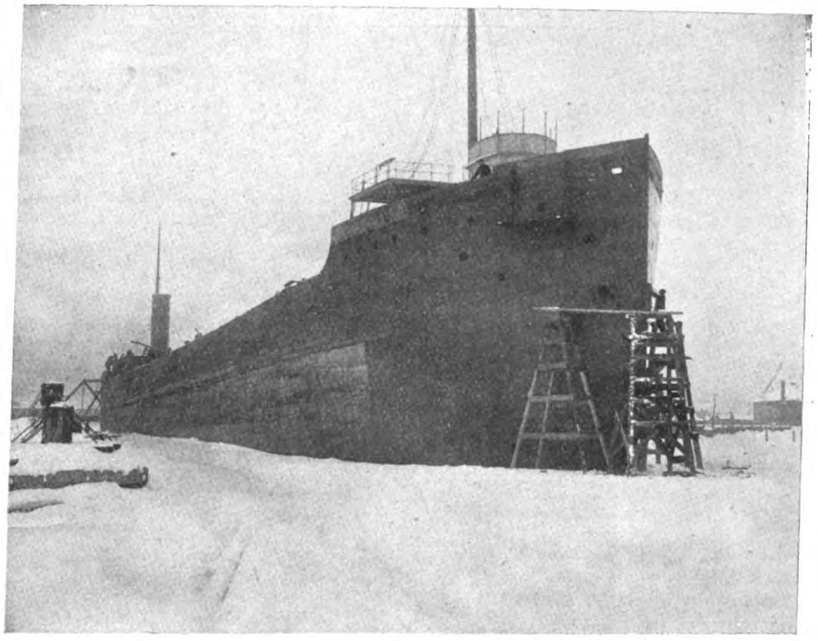


MR. HUGH KENNEDY.

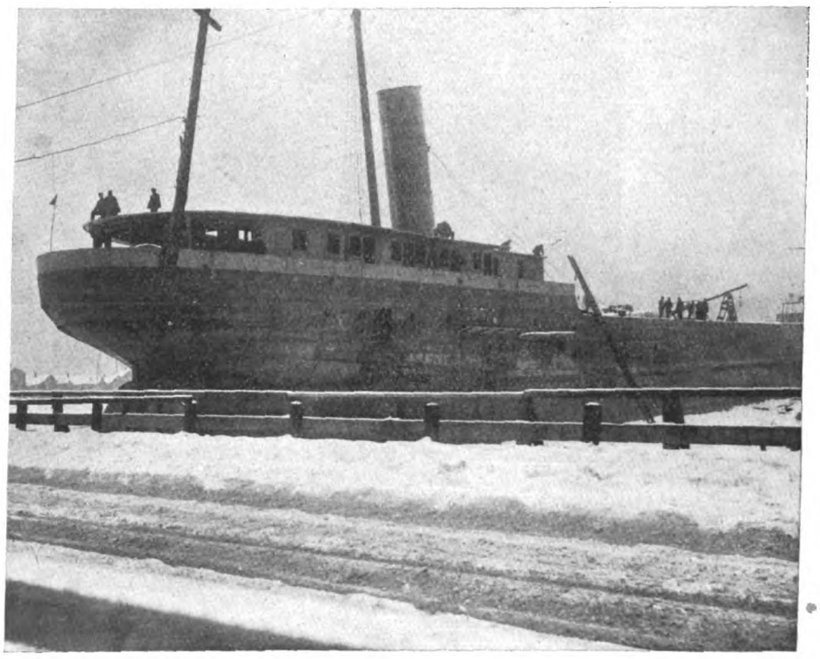
A dinner was given for the launching party at the Union club Saturday afternoon. There were present Mr. and Mrs. Hugh Kennedy, Miss Ruth Kennedy, Mr. W. A. Rogers, Mr. S. M Clement, Mr. Julian Kennedy, Mrs. Phillip Morris, Miss Elizabeth Morris, Capt. and Mrs. John Mitchell, Ralph D. Mitchell, Mr. R. C. Wetmore and Mr. Robert Wallace Sr. Mr. Harvey D. Goulder acted as toastmaster, and brief speeches were made by Mr. Hugh Kennedy, Mr. S. M. Clement, Mr. W. A. Rogers and Mr. Julian Kennedy. All of the speakers paid tribute to Mr. Kennedy. He has been engaged in the manufacture of iron and steel for the past twenty-five years, and many of the labor-saving devices now in common use are his invention. Capt. Charles B. Galton will sail the new steamer.

STEAMER MATAAFA.

The accompanying pictures show the Mataafa as she looks after her reconstruction. The Mataafa was practically broken in two while endeavoring to enter the ship canal at Duluth in the great storm of November, 1905. She was repaired at the Superior yard of the American Ship Building Co., and is now as staunch a steamer as there is to be found on the lakes. Her main deck beams have been cut away to facilitate unloading and compensating stiffening has been added on sides and deck. It will be noted that a cabin has been constructed on the poop deck aft. The crew were formerly housed on the main deck aft, but they all now have quarters in the cabin, including firemen and deck hands, who were formerly housed under the captain's quarters forward. The quarters are commodious and as comfortable as any on the first-class steamers on the lakes. It will be noted, also, that a steel bulwark has been constructed around the port quarter deck aft.



THE RE-CONSTRUCTED MATAAFA.



SHOWING THE NEW CABIN ON THE MATAAFA'S POOP DECK AFT

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Launching the Thomas F. Cole.

The Great Lakes Engineering Works launched at its Ecorse yard on last Saturday afternoon, the bulk freighter Thomas F. Cole, building for the Pittsburg Steamship Co., and named in honor of the president of the Oliver Iron Mining Co., which is the mining end of the United States Steel Corporation. The day was a brilliant one and the launching successful in every particular, although, owing to freezing weather, it was necessary to apply jack screws to start her. The great steamer was christened by Miss Marion L. Wright, daughter of Mr. J. N. Wright of Detroit, sending the bottle flying at the steamer's bow as she gathered momentum on the ways. It was contracted that the Cole should be 3 ft. longer than her sisters the Lynch, Phipps and Baker, but measurements taken on the morning of the launching indicate that she is actually 5 ft. 5 in. longer than her sisters, making her 605 ft. 5 in. over all, or 5 in. longer than the three steamers now building for the Weston Transit Co. The Cole is 58 ft. beam and 32 ft. deep, and on favorable draught can readily carry 12,000 gross tons. Her girders are straight and her hopper sides slope for a distance of 5 ft. and then descend in a straight line to the tank top. Her hatches, thirty-six in number, are spaced 12-ft. centers, the covers being of steel, telescopic, operated with wire lines by four independent engines, two located forward and two aft. President Harry Coulby of the Pittsburg Steamship Co., declared the Cole to have the best constructed hull on the lakes. Her hull construction is unusually staunch, being snap riveted from the main deck to the spar deck, including the standing flange of the gunwale bar. She has steel straps 5 ft. 6 in. wide running fore and aft on either side of the spar deck and extending from within 3 in. of the gunwale bar to almost the edge of the hatch coamings, contributing unusual rigidity longitudinally.

MR. THOMAS F. COLE, PRESIDENT OF THE OLIVER IRON MINING CO.

As the Cole is intended to be the flagship of the fleet, her passenger quarters are unusually commodious. There are five staterooms on the spar deck with three baths. Two of these staterooms, having two double beds in each, occupy the entire width of the deck-house forward, with private bath between them. The other three staterooms have one double bed in each. All the staterooms are paneled in oak with white ceilings and have asbestolith floors. The passengers' observation room is on the texas immediately forward of the captain's office and bedroom. A solid bulkhead divides the observation room from the captain's quarters. The observation room is paneled in oak. The pilothouse is enclosed and is located on top of the observation room. It is finished in dark green There is no communication between the captain's quarters and the observation room or pilothouse. Entrance to both is from the texas deck.

The private dining room and galley are housed in an independent structure on the spar deck, occupying the space that would ordinarily be occupied by No. 2 hatch. This house is 12 ft. by 39 ft. and is finished in quartered oak. It is equally divided between dining room and galley, the galley being on the port side and the dining room on the starboard side. Double windows are fitted in the dining room, one of plate glass and one frosted. The store room for passengers is immediately under the private galley and the ship's dunnage room is immediately under the private dining room.

The quarters for the crew on the main deck forward are very commodious, being directly beneath the passenger quarters and occupying similar area. The chief feature of the crew's quarters is

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a large sitting room very comfortably furnished. The private rooms of the first and second mates are on the port side of the sitting room, and those of the midship steward, wheelsmen and watchmen on the starboard side. Both tub and shower baths are provided for the crew. The duties of the midship steward are exclusively confined to the passengers.

The launching of the Thomas F. Cole was distinguished in many ways. It was distinguished first of all in the spontaneous regard exhibited for Mr. Thomas F. Cole himself, a regard conveyed not alone by those who were present but by those who were absent as well, for every letter of regret received was real and affecting. Certainly if half the things that were said at the ship yard and at the Detroit Club about Mr Cole were true, and doubtless all of them are, he is one of the rarest of men. Mr. Cole was accompanied from New York by Mrs. Cole, Mr. and Mrs. John D. Ryan, Mr. Joseph B. Gilder and Mr. William D. Thornton. Mr. Ryan is the manager of the Anaconda and Amalgamated Copper, and Mr. Gilder is editor of *Putman's Monthly*.

Luncheon was served at the Detroit Club following the launching, and the speeches were lively and animated. Mr. Harry Coulby introduced Mr. Antonio C. Pessano, president and general manager of the Great Lakes Engineering Works, as toastmaster. Mr. Pessano in his opening remarks expressed himself as being sensible of the great privilege which the Great Lakes Co. had in constructing the Thomas F. Cole, and that guests had conferred distinction upon it by coming a long distance to do honor to the Thomas F. Cole.

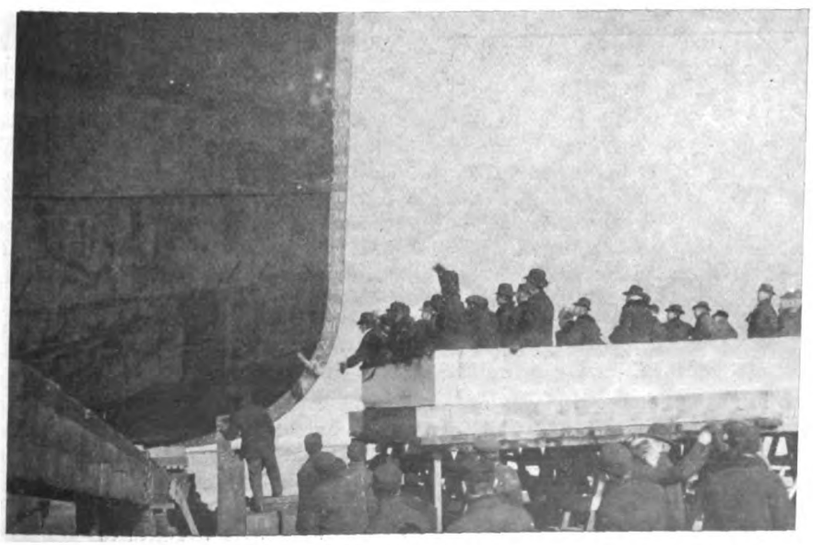
"May her career," said he, "be as bright as the day upon which she was launched."

MR. HARRY COULBY, MRS. JOHN D. RYAN, MR. THOMAS F. COLE, MISS MARION L WRIGHT, MRS. THOMAS F. COLE AND MR JOHN D. RYAN.

"And as staunch," interrupted a voice. "That's taken for granted since the Great Lakes built her," said another.

MR. COLE INSTRUCTING MISS WRIGHT HOW TO BREAK THE BOTTLE.

Mr. Pessano then introduced Mr. Thomas F. Cole. Mr. Cole spoke with ease and freedom and made exactly the kind of speech to be expected from one whose life work had been the winning of the metals. He traced the growth of the ore business from its small beginnings to its present stupendous proportions. He thought the growth of the ore business was something to be marvelled at. It had been thoroughly systemized and is now conducted at reasonably low cost, but not at the expense of labor, because wages are 20 per cent higher than they ever were. He referred with pride to the United States Steel Corporation whose steadying influence is marked, because, as everybody knows, it is bad to have fluctuating values in materials. As the great freighter went overboard the thought occurred to him that she was fashioned of steel won from the old hills of Michigan, transported, smelted and manufactured, and returned to the shipyard to be worked into such a noble instrument. He took occasion to pay a compliment to the Great Lakes Engineering Works, saying that it was clearly shown in its system and order that master men were at work there. He was sure that the new steamer could withstand any of the great storms and contrasted the difficulties of lake and ocean navigation, pointing out that the rivers are more difficult to navigate than the high seas. He added, however, that if the Thomas F. Cole exhibits the same love of rocks as her namesake, she might find navigation venturesome. Speaking of the wonderful growth of the United States and its unexampled prosperity he said it simply meant that the miner was at work winning in conjunction with



SENDING THE BOTTLE FLYING AS THE COLE GATHERED MOMENTUM ON THE WAYS.

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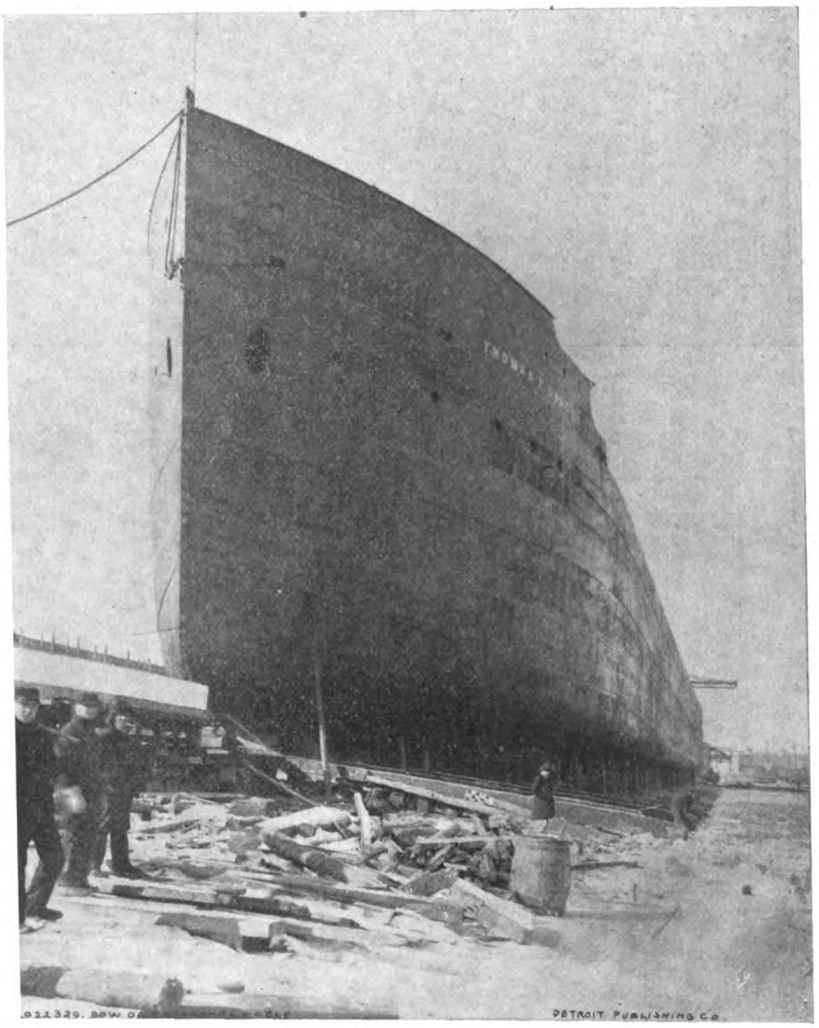
iron, copper and lead, sufficient proportion of the precious metals to give stability to our currency system. In parenthesis he added that 80 per cent of the mineral resources of the United States were yet awaiting development, an index of great opportunities ahead and greater prosperity still to come. Mr. Cole's remarks and I want the company to note that Mr. Cole says that she must be the best furnished boat on the lakes as well. It is an honor for me to be here this afternoon. Nothing, indeed, ever gave me greater pleasure than persuading the Corporation to name one of its great steamers after Thomas F. Cole. In the



BOW VIEW OF THE THOMAS F. COLE ON THE STOCKS.

were delivered thoughtfully and he was listened to with great attention.

In introducing Mr. Harry Coulby Mr. Pessano stated that it was easy to build ships but difficult to manage them, and he predicted that the time would come when the country would see Mr. Coulby in Washington as secretary of the navy.

"I'll never take that job," said Mr. Coulby quickly. "I always go for the big things, but Pessano, I may some day offer you that place."

This sally was received with great applause.

Continuing, he said: "I wish to say that the Cole is the best constructed hull that has been built on the great lakes, pioneering of the great northwest Thomas F. Cole stands forth as a man."

Mr. G. A. Tomlinson in speaking of Mr. Cole's constant good nature said that he reminded him of a character in one of Van Dyke's books, "He always turned his face toward the morning." He then related one of Mr. Cole's great successes in copper development, of which he, however, declined to absorb the profit, but permitted his friends to take advantage of it, saying that Mr. Cole expressed himself as being happier that his friends were a little more prosperous on account of his efforts, than if he had laid it aside for himself.

Mr. J. N. Wright of Detroit, spoke of his connection with Mr. Cole in the Upper Peninsula twenty years ago.

Mr. Joseph B. Gilder expressed great disappointment in Mr. Cole's speech, adding that so great were his virtues and merits that he was constantly on the alert to discover some imperfection in him. When Mr. Cole was called upon to speak Mr. Gilder thought that his opportunity had come, but was met with bitter disappointment, since Mr. Cole made an admirable speech. He admired Mr. Cole's love of rocks in a state of nature and his contempt of them in a refined state as the term is commonly applied. He added that he would like to see Mr. Cole a New Yorker, but would prefer that he remained in the west if he ever became like the ordinary New Yorker. What he meant by that was that such a man as Cole is, who has no love for money merely for money's sake, but on the contrary despises it, could not be produced in New York. He is a product of the west, which in its breadth and greatness he resembles.

Capt. J. W. Morgan, who is to sail the Cole, upon being called upon said: "If I talked to you for two hours I could not convince you that I could run that boat, but if you will come with me next summer, I'll show you."

Certainly herein is expressed much in little, and no speech of a single sentence ever met with greater applause.

Mr. George H. Russel is one of the best of after-dinner speakers, but he was troubled so by a cold as to make articulation extremely difficult. He made, however, a very good speech, hoping that the ship would prove as strong and capacious as the man for whom she was named; would be a worthy product of the important plant at which it was constructed and would be all that her master and owner could desire.

Mr. John D. Ryan related how he had threaded the canyons of New York with Mr. Cole, as well as the canyons of the west, and that if anybody wanted his job he was ready for a business proposition. Mr. Ryan said that he was proud of the Steel Corporation as an American company and proud of Cole as a man, who had risen from the ranks with a name and reputation unblemished and untarnished. He regarded him as an ideal American citizen, a credit to himself, to his companions and to the company.

He related that his company in developing its property out west had some very bad neighbors which it was necessary to get rid of. The company sent for Cole and were very glad they did, as the bad neighbors speedily moved.

"Did he have to use jack screws," inquired Mr. Pessano.

"Well, at any rate," replied Mr. Ryan, "the ways were not greased".

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to Mary Lowe, of Detroit, and she, together with the six children who survived him, are all still living. Gordon Campbell was the soul of honor and integrity, and his memory is still fresh along the lakes.

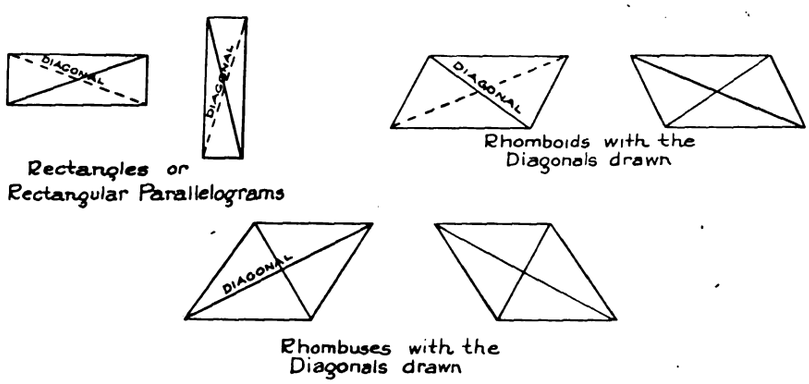
COMPOSITION AND RESOLUTION OF FORCES AND MOTIONS.

BY CLARENCE E. LONG.

(The following brief explanations will help to explain questions 327, 328, 329, 330 and 335 of the Questions for Masters and Mates.)

Motion is change of position.

Force is that cause which moves or stops a body or tends to alter its state of rest or motion.



Velocity is the rate of speed at which a body moves.

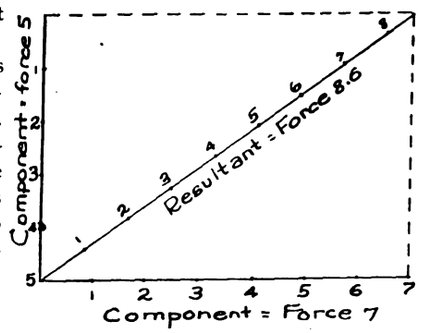
Composition of forces and motions is a combination of forces and motions, that is, more than one of either.

The resolution of forces and motions is the result of two or more forces or motions. When the effects of two or more forces, tending to move, alter or stop a body, are resolved into their total effect it is called the Resultant of those forces.

Motion is the direct outcome of force, and the composition and resolution of motions are in all respects analagous to those of forces. It is therefore quite admissible, and will be convenient here, to deal with them as synonymous or convertible terms.

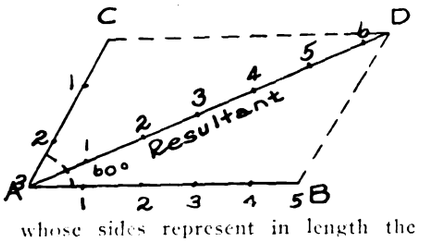
A single force may be represented on paper by an arrow-headed straight line; the commencement of the line indicating the point of application of the force—the direction of the line, the direction of the force—and the length of the line, the magnitude or intensity of the force, according to the scale made use of.

A vessel steaming in slack water (water not moving) will make a mathematically true wake if steered true to her course, with no wind to cause leeway, and all other conditions equally as favorable. Her motion and force may be represented by a straight line. If her engines develop a speed of 10 miles an hour so is her velocity through the water 10 miles an hour. If there is a current from the same direction in which the vessel is steaming then the vessel will be retarded in her speed by a force equal to the speed or velocity of the current. If the current has a velocity of two miles an hour the speed of the vessel through the water will be but eight miles an hour. If this current were moving in the same direction as the vessel is proceeding, then the ship's speed will be accelerated by it, or the speed now will be 12 miles an hour. When a current acts in the same line with



the ship's keel, the problem is a very simple one to solve, but when a current makes an angle with the ship's course the problem is not so simple.

The resultant of two forces equals the diagonal of a parallelogram,



whose sides represent in length the respective forces, and whose angle is equal to the angle between the forces.

OF QUADRILATERALS.

A plane figure of four sides is called a quadrilateral. When the opposite sides are parallel, the quadrilateral is called a parallelogram. There are four kinds of parallelograms, the square, rectangle, rhomboid and rhumbus. A rectangle is a parallelogram all of whose angles are right angles. When the four sides of a rectangle are equal to each other, it is called a square. The term oblong is frequently applied to rectangles whose adjacent sides are unequal. A rhombus is a parallelogram all of whose sides are equal, but whose angles are oblique. When the adjacent sides of a parallelogram are unequal and the angles are oblique, it is called a rhomboid. The straight line joining the opposite angles of a parallelogram is called its diagonal.

The opposite angles in any parallelogram are equal. Equal angles give equal sides, and equal sides give equal angles.

TO FIND THE RESULTANT OF TWO FORCES.

Suppose the forces acting at right angles upon a body to be respectively of seven units, which may mean of distance or of speed, as so many miles, feet, fathoms, etc., or of weight, such as so many pounds, tons, etc., and of five units. Draw a parallelogram, making one side seven units long, and the other side five units long. Draw the diagonal. The number of units in this diagonal equals the number of units in the resultant force, or the resultant force is the sum or total effect of the other two forces, or components, as they are called.

Often two forces act upon a body at a greater or lesser angle than a right angle. The angle of the parallelogram must always equal the angle between the forces. Suppose, however, the forces acted upon each other at an angle of 60 degrees—two-thirds of a right angle. We must first draw two lines meeting at an angle of 60 degrees, then making one line AB five units long, and the other AC three units long, complete the parallelogram. The diagonal AD, drawn from the point where the forces acted, is the resultant.

To allow for a known current in shaping the course is only one of the numerous applications of the composition or parallelogram of forces, in which the resultant (diagonal) represents the course and distance made good, the current, its direction and velocity, one component or force, and the speed and direction of the ship, the other component.

To draw a parallelogram to represent this proceed as follows: On a chart using parallel ruler and chart compass diagram and dividers, lay off a line (passing through the ship's po-

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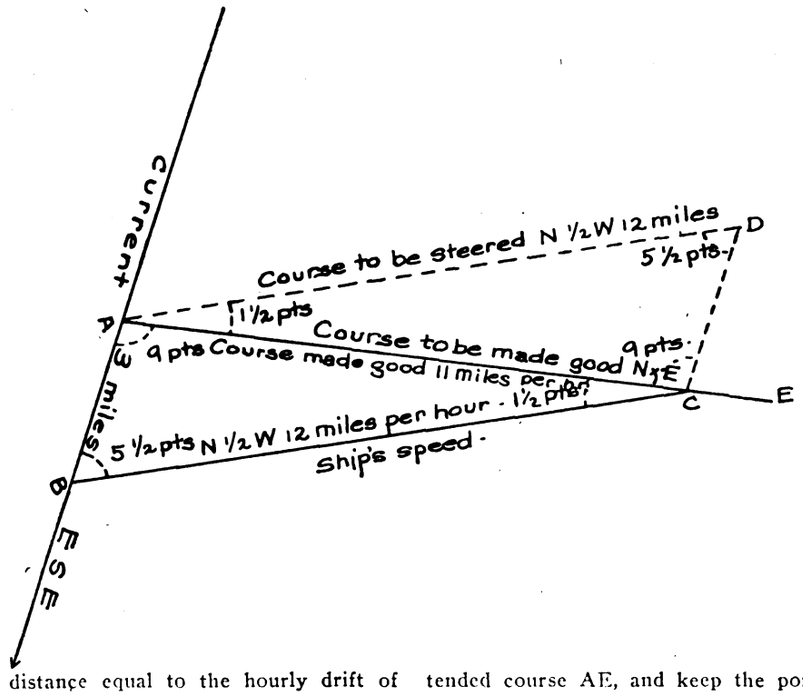
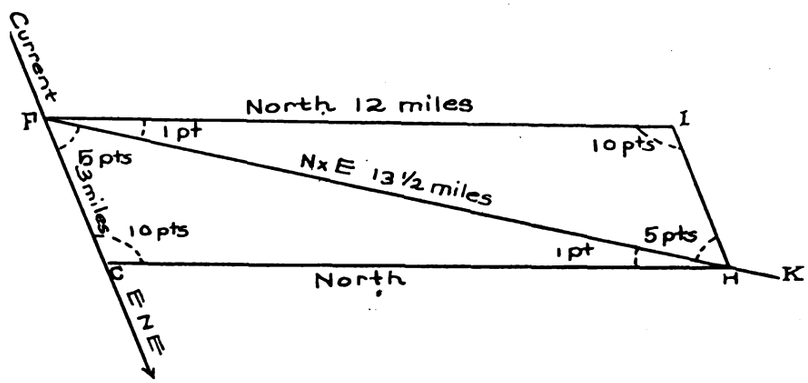
sition) in the direction of the set of the current, and from the position of the ship, lay off on this same line a



distance equal to the hourly drift of the current, taking the measurement from any convenient scale, say an inch to the mile. From the ship's position lay off the direction of the course to be made good. This line will be the diagonal of the parallelogram. Now, with the ship's speed per hour between the points of the dividers (using the same scale as before), place one leg of dividers at the point at the end of the line representing the direction of the current and velocity for one hour, and let the other leg come where it will on the line representing the course to be made good. The direction of the line representing the speed of the ship will be the direction of the course to be steered in order to make good the course that the ship desires to make.

An illustrated example will show this clearly: A ship desires to make good a course of N by E but has a current to overcome that is setting ESE at the rate of three miles an hour; the ship steams 12 miles an hour. What course must she steer and what speed is she really making per hour?

Let A in the following diagram represent the place of ship. Through A draw the line to represent the direction of the current and AB its velocity per hour (three miles.) E is the port, bearing N by E from ship at A. With a span of 12 miles between the points of dividers place one leg at B and let the other leg touch the line AE at the point C. Therefore, BC represents the course to be steered in order to make good her intended course AE, and keep the port all the time on the same line of bearing. The course to be steered is



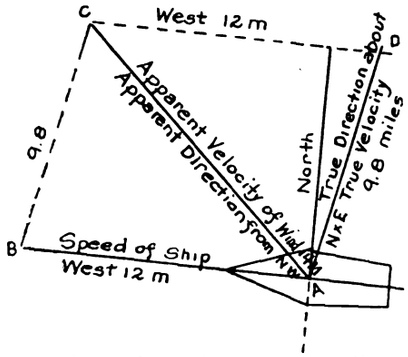
N½W. We draw AD parallel to BC and DC parallel to AB to complete the parallelogram and show its principle. AB and DC are equal. They show the amount of drift for one hour. It must be remembered that although the ship is steering in the direction of the line AD she is really on the course ACE all the time.

So long as the current sets at an angle less than 90 degrees from the course the current is retarding the speed of the ship. In the above case at the rate of one mile an hour. The speed of the engines is 12 miles, but the vessel's speed is 11 miles. When the set of the current is more than 90 degrees from the ship's course, then the current is favoring the vessel. The following diagram will explain this. The engines are making a speed of 12 miles themselves, but the current is helping the ship along at the rate of 1½ miles per hour.

If the chart scale of miles is used, it will generally be necessary to multiply the vessel's speed and the drift of the current by some convenient factor—say five—so as to get a good working size for drawing the figure. If a protractor is used instead of parallel ruler the work can be done on an ordinary sheet of paper. No up-to-date navigator can hardly get along without a protractor.

To determine when aboard ship the true direction and force of the wind from its apparent direction and force together with the course and speed of the ship, is another application of the composition of forces.

Any one at all observing or who has given the matter any thought, must be familiar with the fact that there is oftentimes a great difference between the apparent direction and velocity of the wind, as indicated by vanes, flags, or pennants on board ship, and the true direction and velocity with which the wind is blowing. This is due to the fact that the ship moves in addition to the movement of the wind. If the observer were stationary the apparent direction and velocity would also be its true direction and velocity. Practical seamen



sometimes determine the true direction and force of the wind from indications outside of the ship, such as the waves, clouds, the smoke, some

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time after it has left the funnels, etc. At night and during fog this cannot be done, so recourse must be had to other methods. There will apparently be a calm on board a steamer going 12 miles an hour when the wind is really blowing with a force of 12 miles from right aft, and on the other hand the wind will blow with an apparent force of 24 miles an hour from dead ahead on board a steamer going 12 miles an hour, when its true force is only 12 miles from dead ahead. When the apparent direction of the wind is at an angle with the vessel's course the true direction and velocity can be determined from that angle and the velocity of the wind and the speed of the vessel. This may be demonstrated by the parallelogram of forces as in the diagram.

In the diagram following let AB represent the course and speed of a vessel in miles per hour and CA the apparent direction and velocity of the wind in miles per hour, as shown by a vane on board the vessel; then connecting B and C and completing the parallelogram ABCD, the line DA will represent the true or actual direction of the wind and the velocity in miles per hour. Supposing a vessel steaming along AB, or west 12 miles an hour, having the wind apparently along CA, or from the NW 14 miles an hour; then the line DA must have the direction of about one point abaft the beam, its proportional length must be 9.8, or nearly 10 miles. Therefore the true direction of the wind in this case is about N by E, and its true velocity nearly 10 miles an hour.

A scale of centimeters makes a most convenient scale for laying off the distances in this kind of work. Let each centimeter stand for a mile. It is convenient because it gives a fair working size to the diagrams. It is likewise convenient because the centimeter is divided into tenths. In the foregoing diagrams each mile represents a centimeter, or the centimeter is taken as the unit.

It is well to know that the true direction of the wind is always further from the bow than the apparent direction. The true force of the wind is greater than the apparent so long as the apparent direction is aft of the beam. The true force of the wind is less than the apparent as long as the true direction is forward of the beam.

There are a great many other applications of the parallelogram of forces that might be mentioned in connection with these. There is scarcely a limit to the application of this important principle in the science of forces. It comes into play in a marked manner in determining the weight of span rigged between masts, etc., will sustain. We will give some examples of these another time. This subject is not only a very useful one, but a simple one as well, and as it is not beyond the reach of those who try, one should not be satisfied with himself until he knows all about it.

QUESTIONS FOR MASTERS AND MATES.—No. 28.

415. If the deviation is Ely on north, what will it be on south?

416. What is meant by natural deviation?

417. What is residual deviation?

418. Your boat heads correct magnetic NE, your compass says NE½N, how much and which way is the deviation?

419. Your boat is heading West correct magnetic, your compass says W by S; how much and which way is the deviation?

420. If the natural deviation on West is Wly, what will it be on East?

421. With a compass having natural deviations (compass unadjusted) it is necessary to steer NNW to make good a course of North, what would you steer in order to make good a South course, presupposing that the deviation is of the same amount on south as on north?

422. State briefly the essential parts of a good reliable working compass.

423. How could you tell which was the north and south end of a magnet.

424. How could you tell an efficient compass?

425. If you were to test the efficiency of a compass would you do it on board your ship or on shore?

426. Why is it that no two uncompensated compasses on board do not show the same heading of the ship?

427. Is it necessary to have compasses adjusted?

428. Name some of the advantages of an adjusted compass over one uncompensated.

429. What is meant by transient induced magnetism?

QUESTIONS FOR WHEELSMEN AND WATCHMEN.—No. 29.

291. Explain how you would pilot a boat from one mile south of Portage entry to Princess Point, Portage river.

292. Explain how you would pilot a boat from Princess Point, Portage river, to Houghton and Hancock bridge

293. Explain how you would pilot a boat from Houghton and Hancock bridge to Lilly Pond.

294. On what side would you leave ranges 2 and 3 in passing up Portage river?

295. If you were piloting a steamer up Portage river, what order would you give wheelsmen when you came to Princess Point?

296. What is the general appearance of the land on both sides of the river from Portage entry to Portage lake?

297. What are the correct magnetic bearings of Portage river ranges 14 and 15?

298. With stern of your boat on Portage river ranges 14 and 15, your steering compass reads N x W¼W, how much would it be out on those ranges and which way?

299. What signal do you give if you wish to pass through Houghton and Hancock bridge?

300. On what hand do you leave Osceola Point bound up Portage lake?

301. On what hand would you leave Harrington Isle passing up Portage lake?

302. Give general appearance of land around High Point, Portage lake.

BATTLESHIPS AND ARMOR.

Following the action of President Roosevelt in making a personal appeal for the construction of at least two monster battleships, in line with the policy of Great Britain, there has been wide discussion of the question. Edwin S. Cramp, vice president of William Cramp & Sons' Ship & Engine Building Co., Philadelphia, is quoted as follows:

"As a general proposition there is little doubt that the policy of the American navy will tend in the direction of smaller fleets of larger vessels. England has set the example, and the other countries are following. The policy is a good one, in my opinion. Five large battleships making up a squadron, each with eight large guns, will prove much more effective, as a fighting unit, than ten ships with four guns each. Not only will the fleets take up smaller space, but they will be more easily maneuvered, which, of course, will be a great advantage."

Before the house committee on naval affairs, Secretary Bonaparte explained the recent division of armor plate awards among the Bethlehem, Carnegie and Midvale Steel companies, half going to the last named company, which was the lowest bidder. The idea of this division, he stated, was to make clear the stand of the department that "it would act on the principle of getting the armor at the lowest possible rate for the government, with due regard to the possible future exigencies of the occasion." Mr. Bonaparte was unable to state just what process is now being used in the manufacture of armor plate.

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DECISIONS AFFECTING SHIPPING INTERESTS.

NEGLIGENCE IN TOWING.—The Circuit Court of Appeals for the Second Circuit, in a recent case, holds that where the master of a canal boat at the time she was taken in tow had a master on board who in accordance with the usual custom undertook to make fast the tow line on such boat, the tug is not responsible for his negligence in performing such duty resulting in an injury to the tow through her going adrift by reason of the insecure fastening of the line and coming in collision with other vessels.

DEGREE OF CARE REQUIRED IN TOWING.—The entrance to the harbor at Duluth is through a canal 1,200 feet long and 300 feet wide, which extends in a generally easterly and westerly direction, and is bounded by heavy cement piers on each side. The steamer John Harper was towing the barge Gawn, a sailing vessel from the vicinity of Devil's Island, on the usual course, to the port of Duluth. The Gawn struck the south pier and was injured. The Circuit Court of Appeals for the Eighth Circuit held that it was negligence for a laden steamer which was towing a sailing vessel light upon a line 900 feet long when the steamer approached the canal from a southerly direction into a northwesterly wind of 35 to 40 miles an hour which blew nearly athwart the line of the canal to fail to wait for a tug or take some other reasonably safe course, and to attempt to draw the barge, whose lights were visible, and which was drifting far to the leeward, into the canal. The case also holds that the master of the barge, who first learned when he was moving at the rate of 10 miles an hour, and was within 200 feet of the south pier, that his vessel would be drawn against it, was not guilty of contributory negligence because he failed to throw off or cut his tow line before his barge strikes the pier. As to the duties involved in towage the court holds that a steamer which engages to tow a vessel to a port undertakes to exercise reasonable skill and care in everything relating to the work, including the entrance to the port, and the lack of it either charges her with liability for the damage caused thereby. In reply to the allegation that the master of the Gawn was negligent in not cutting her line when he saw the danger, the court holds that the acts and failures of a master of a vessel to act after it has been put in extremis by the negligence of another, do not ordinarily constitute contributory negligence, even when erroneous.

RIGHTS AND LIABILITIES OF PART OWNERS OF VESSELS.—The mere fact that several persons are part owners of one vessel does not, it is well settled, make such persons partners, nor the vessel partnership property. Partnership is not inferable from part ownership. If a partnership exists between part owners, it exists by virtue of some agreement, expressed or implied, and does not arise, and cannot be implied, from the fact that several persons own a vessel by a tenancy in common. In the absence therefore, of some agreement between part owners by which they form themselves into a partnership, or of dealings by such owners, either between themselves or with third parties, from which a partnership may be implied, the relation between them is that of tenants in common and not of partners. However, there is no doubt that a vessel, like any other chattel, may be made a subject of partnership property, or that part owners may, if they choose, assume the relation of partners. There is nothing in the nature of a vessel which would render it different in this respect than any other species of personal property, and if it be shown that it is owned and regarded by the parties as partnership property, it will be so treated by the courts.

The distinction to be observed is the distinction between the relation of the part owners to the vessel and to the business in which the vessel is employed. Part owners of a ship may be tenants in common of the vessel, and yet may employ it in an adventure with reference to which they are partners. The vessel would not, in such case, become partnership property, while its earnings would undoubtedly be the result of a partnership venture, and properly regarded as partnership funds.

The instances in which the vessel itself has been held partnership property are few. If a partnership owns a moiety of a vessel, such share is of course partnership property, and may be disposed of as such by any partner. The mere fact that a vessel owned by several is employed in an enterprise for the common profit of all the owners, or under an agreement to own the ship on shares, does not make the part owners partners in their ownership of the vessel. Even where such an arrangement amounts to a partnership among the owners of the vessel as to its employment, only the use of the boat and not the boat itself is brought into the partnership. While partners in the use of the vessel they remain part owners and tenants in common of the vessel.

A vessel bought by several persons does not become partnership property because it was purchased as a speculation and with a view to its resale rather than to its employment in trade. Partnership among part owners with reference to the employment of the vessel are far more frequent than its ownership. Their relation as tenants in common of the vessel is entirely consistent with a partnership as to the business of the boat. In such a case their liabilities as to third persons incurred in the business employing the vessel are partnership liabilities, and the earnings of the vessel are partnership funds.

Persons occupying toward each other the position of co-owners merely, do not as such stand in a relation of a very high fiduciary character. In a Massachusetts case an action was brought by one part owner against his co-owners for having conspired, after agreeing upon a sale of the vessel at a large price, to induce the plaintiff's agent, by a concealment of the fact that the vessel could be sold for such price, and by false and fraudulent representations to sell the plaintiff's quarter interest in the vessel at a price much below that which they had so agreed to sell for. The court said: "The Court are of the opinion that the tenants in common of a vessel who are not engaged jointly in the employment of purchasing and building ships for sale, do not stand in such a relation of mutual trust and confidence toward each other in respect to the sale of such vessel that each is bound in his dealings with the other to communicate all the information of facts within his knowledge which may affect the price or value. A different rule may prevail in respect to any contract for the use or employment of the common property, in which relation, perhaps, they may be deemed to place confidence mutually in each other. But, as in common cases of tenants in common of a vessel, they are independent of each other in all matters of purchase and sale, and may deal with each other in the same manner as owners of separate property. Each may act upon the knowledge which he has, without communicating it."

GRAIN RECEIPTS AT BUFFALO.

Junius S. Smith, lake weighmaster, reports the total receipts of grain and flax at Buffalo during the season of 1906 to have been as follows:

	BUSHELS.	TONS.
Wheat	55,811,000	1,674,330
Corn	25,860,000	724,080
Oats	24,032,000	384,512
Rye	1,140,000	31,920
Barley	13,920,000	334,080
Flax Seed	15,360,000	430,800
Total	136,123,000	3,579,722

Of this total of 136,123,000 bu., the proportion shipped by the various ports are as follows: Chicago, 26,011,707; Milwaukee, 2,287,067; Toledo, 122,000; Duluth and Superior, 34,583,926; Washburn, 1,571,628; Gladstone, 2,935,329; Green Bay, 2,867,703; Manitowoc, 804,820; Fort William and Port Arthur, 7,213,120.

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